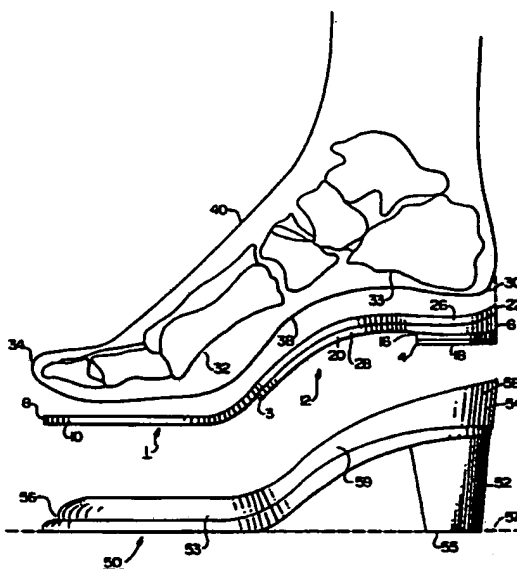




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: **HIGH-HEELED SHOE ORTHOTIC DEVICE**

## (57) Abstract

An orthotic device for insertion into a high-heeled shoe is provided, which orthotic device virtually eliminates the problems associated with the wearing of high-heeled shoes, particularly pronation effects, general foot discomfort, posture problems, toe pain, and arch pain. The orthotic device comprises a rigid or semi-rigid shell (28) for positioning beneath the heel (30) of the foot (40) and extending forwardly towards the toes (34) of the foot (40). The shell (28) terminates behind the five metatarsal heads (32) of the foot (40), and is shaped whereby to permit the first metatarsal head freely to evert and plantarflex under load, and is shaped such that the heel (30) of the foot (40) is carried substantially parallel to or slightly backwardly inclined relative to the ground plane.

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1                    HIGH-HEELED SHOE ORTHOTIC DEVICE

2                    Background of the Invention

3                    Field of the Invention

4                    This invention relates generally to orthotic devices,  
5                    and more specifically to orthotic devices for use in high-  
6                    heeled shoes.

7                    The human foot may be subject to a number of  
8                    abnormalities which cause pain. A number of corrective  
9                    constructions have been devised for curing these problems.  
10                   These corrective constructions are generally referred to  
11                   in the art as "orthotics" and may be integrally formed in  
12                   a shoe or adapted to be received by a shoe. Such orthotic  
13                   devices commonly are used to correct abnormalities and/or  
14                   to prevent foot problems or injury arising from the  
15                   wearing of high-heeled dress shoes. While there has been  
16                   substantial investigation by prior art workers into  
17                   orthotic devices for use with athletic footwear, there has  
18                   been little work into designing orthotics for reducing  
19                   injury or increasing comfort of high-heeled dress shoes.

20                   A standard high-heeled dress shoe is designed so that  
21                   the heel of the foot wearing the shoe is carried higher  
22                   than its toes. The height differential between the heel  
23                   and the toes can vary significantly depending on the style  
24                   of the shoe. It is not uncommon for heel heights to range  
25                   from 1 1/2" to 3" or more above the toes in certain  
26                   styles. Also, high-heeled shoes typically are designed  
27                   with pointed toes in order to exhibit greater fashion  
28                   appeal. While the design of these pointed toes also vary,  
29                   it is generally common for fashion high-heeled shoes to  
30                   maintain pointed toes regardless of the shape of the  
31                   wearer's foot. A number of painful foot problems result  
32                   from this design. For example, the downward slant of the  
33                   inner sole of the shoe forces the wearer's foot to slide  
34                   forward toward the toes. As the foot slides forward, the  
35                   toes become jammed in the toe portion of the shoe. This  
36                   can be very painful and it has been shown that at least

1 85% of all high-heeled shoe wearers experience such pain.  
2 Moreover, the downside slant of the inner sole places  
3 stress on the foot as the foot attempts to conform to the  
4 downward slant of the inner sole, causing the heel bone or  
5 calcaneus, to tilt downward, or plantarflex, thereby  
6 locking the first metatarsal phalangeal joint and  
7 preventing hallux extension or "toe lock". This causes  
8 the foot to pronate, greatly decreasing the overall foot  
9 comfort as well as adversely affecting the wearer's  
10 posture and ambulation all as described in U.S. Patent  
11 4,597,195 to Dananberg, one of the inventors hereof.  
12 Therefore, wearers of high-heeled shoes often complain of  
13 problems associated with toe pain, arch pain, as well as  
14 general lower back problems.

15 Unfortunately, no teaching exists in the prior art to  
16 construct an orthotic device that adequately corrects foot  
17 posture while permitting conventional high-heeled shoes to  
18 be worn. Typically, an orthotic device consists of  
19 several components: the heel post of rear stabilizer  
20 component located directly beneath the heel seat of the  
21 orthotic, the shell or arch accommodating section which  
22 runs from the heel to a point just behind the metatarsal  
23 heads of the foot; and the extension component that runs  
24 from a point at the end of the orthotic shell to the point  
25 where the toes join the body of the foot, commonly called  
26 the sulcus.

27 Richardson et al, U.S. Patent No. 1,778,002 discloses  
28 an orthotic in which the shank is provided with extension  
29 which are intended to act as an arch support. The shank  
30 extensions contemplated in Richardson extend laterally  
31 from the shank of the sole, extending outwardly at an  
32 acute angle with respect to the sole. The disadvantage  
33 of this construction is that it requires a sole with  
34 relatively high sides to protect or conceal Richardson's  
35 orthotic device. Moreover, the wider or higher such  
36 lateral extensions are, the more pressure may be exerted

1 on the side or arch, vamp, foxing, and order of the shoe,  
2 thereby distorting the shape of the shoe itself.

3 It is also known in the prior art to provide orthotics  
4 comprising pads attached to the insole. These may take  
5 the form of metatarsal pads, midtarsal pads, or heel spur  
6 pads, such as those disclosed by Riehle et al, U.S. Patent  
7 No. 1,867,679, Frese, Jr. in U.S. Patent No. 2,959,875,  
8 Nalick, U.S. Patent No. 3,777,419, and Stemmons, U.S.  
9 Patent No. 2,075,552.

10 Riso et al, U.S. Patent No. 4,250,886 discloses an  
11 orthotic for a high-heeled shoe and comprising a sole  
12 including heel and forefoot receiving portions, the heel  
13 portion being elevated approximately 1 1/2" about the  
14 forefoot portion. Riso's orthotic also provides a  
15 metatarsal pad secured to the sole and dimensioned so as  
16 to have one marginal edge substantially adjacent and  
17 proximal to the head of the second metatarsal, a second  
18 metatarsal edge substantially adjacent and lateral the  
19 first metatarsal and a third metatarsal edge substantially  
20 adjacent and medial to the fifth metatarsal. However,  
21 Riso requires that the orthotic position of the foot such  
22 that a constant height of 1 1/2" is maintained between the  
23 heel and forefoot even if the heel height exceeds 1 1/2".  
24 Thus, in a shoe with a standard heel height of 1 3/4" an  
25 orthotic made in accordance with Riso would place a 1/4"  
26 pad under the forefoot to maintain the constant 1 1/2"  
27 between the heel and the forefoot, and a 2" heel would  
28 require a 1/2" pad under the forefoot. The inclusion of a  
29 pad of 1/4" - 1/2" thickness in a modern high-heeled shoe  
30 would crowd the wearer's toes, resulting in toe pain, and  
31 exacerbating the problem of toe lock discussed in  
32 Dananberg U.S. Patent 4,597,195.

### 33 Objects of the Invention

34 An object of the present invention is to provide an  
35 orthotic device adapted for insertion into a high-heeled  
36 shoe which overcomes the aforesaid and other problems of

1 the prior art. A more specific object of the present  
2 invention to provide an orthotic device that is capable of  
3 eliminating toe pain and toe lock of the wearer of a high-  
4 heeled dress shoe.

5 Yet another object of the present invention is to  
6 provide an orthotic device that is capable of improving  
7 the wearer's posture, general foot comfort, and of  
8 eliminating foot arch pain as well as general lower back  
9 pain.

10 A still further object of the present invention is to  
11 provide an orthotic device that is useful in high-heeled  
12 shoes having a wide range of heel heights including heel  
13 heights of two or more inches.

#### 14 Summary of the Invention

15 The present invention provides an orthotic device  
16 adapted to be inserted into a heeled shoe defining a  
17 ground plan and also being adapted for receiving a human  
18 foot thereon. The orthotic device contemplated by the  
19 instant invention comprises a rigid or semi-rigid shell  
20 for positioning beneath the heel of the foot, and  
21 extending forwardly toward the toes, but terminating  
22 behind all of the five metatarsal heads, and is shaped  
23 such that the first metatarsal head specifically can be  
24 allowed to plantarflex and evert under load. The rigid or  
25 semi-rigid shell has a shape such that the heel of the  
26 foot is carried substantially parallel to the ground  
27 plane, or the heel is tilted slightly backwards.  
28 Typically, the part of the shell underlying the heel will  
29 be tilted at an angle of from about 4 to about 22.5  
30 degrees to accommodate for the downward slant of the shoe.  
31 The actual angle is related to shoe heel height. The  
32 higher the heel, the greater the accommodative angle.

33 In a preferred embodiment of the invention the  
34 orthotic device also comprises a heel post attached to the  
35 shell for positioning beneath the heel of the foot, and  
36 extending forwardly toward the toes of the foot. The heel

1 post terminates behind the heel bone of the foot and is  
2 adapted to assist the shell in carrying the heel of the  
3 foot in a substantially parallel position relative to the  
4 ground plane. Also, in a preferred embodiment of the  
5 instant invention the heel post has a thickness that  
6 assists the shell in carrying the heel of the foot in a  
7 substantially parallel or slightly tilted back position,  
8 and specifically may have a thickness that increases from  
9 the heel of the foot towards the toes thereof and from an  
10 outer portion of the foot towards the arch thereof.

11 Other variations and modifications are possible. For  
12 example, the curved portion of the shell is adapted as a  
13 function of the height of the heel of the shoe above the  
14 ground plane in order better to carry the heel of the foot  
15 in the aforementioned substantially parallel or slightly  
16 tilted back position relative to the ground plane. Also,  
17 in other modifications, the orthotic device may also  
18 comprise a recessed heel portion that is adapted to  
19 receive the heel of the foot, and a cushioned, flexible  
20 extension component is attached to the shell and  
21 positioned beneath the heel, and extending forwardly  
22 toward the toes of the foot to terminate behind the sulcus  
23 of the foot.

#### 24 Brief Description of the Drawings

25 Other features of the present invention will become  
26 apparent as the following description proceeds and upon  
27 reference to the drawings, wherein like numerals represent  
28 like parts and, in which:

29 Figure 1 is a top view of one preferred embodiment of  
30 the instant invention;

31 Figure 2 is a side view along the inward portion of  
32 the preferred embodiment depicted in Figure 1;

33 Figure 3 is a side view of an outward portion of the  
34 preferred embodiment depicted in Figures 1 and 2;

35 Figure 4 is a bottom view of the preferred embodiment  
36 depicted in Figures 1-3;

1        Figure 5 is a diagrammatic view of the embodiment  
2 depicted in Figures 1-4 with the skeletal outline of a  
3 human foot disposed thereon;

4        Figure 6 is a top view showing details of the toe end  
5 of the orthotic device made in accordance with the present  
6 invention;

7        Figure 7 is a side view similar to Figure 2, and  
8 showing details of a heel post construction in accordance  
9 with the present invention; and

10       Figure 8 is a bottom view of the alternative  
11 embodiment depicted in Figure 7.

12       While the present invention will hereinafter described  
13 in connection with preferred embodiments and methods of  
14 use, it will be understood by those skilled in the art  
15 that it is not intended to limit the invention to these  
16 embodiments. On the contrary, it is intended to cover all  
17 alternatives, modifications, and equivalents, as may be  
18 included within the spirit and broad scope of the  
19 invention as defined only by the appended claims.

20       Detailed Description of the Preferred Embodiments

21       Turning to the drawings, there is provided an orthotic  
22 device 1 adapted to be inserted into a high-heeled shoe 50  
23 which is shown relative to a ground plane 57 formed by the  
24 intersection of the bottom 53 of the foreshoe 56 and the  
25 bottom 55 of the heel 52. The orthotic device 1  
26 contemplated by the instant invention is adapted for  
27 receiving a human foot 40 thereon and comprises a rigid or  
28 semi-rigid shell 28 for positioning beneath the heel 30 of  
29 the foot 40 and extending forwardly toward the toes 34 of  
30 the foot 40. Referring in particular to Figure 6, at the  
31 forward or toe end 3 of the rigid or semi-rigid shell 28,  
32 i.e. at the point on the orthotic where the first  
33 metatarsal shaft comes in contact with the shell, an area  
34 is removed from the shell so as to permit the first  
35 metatarsal head to evert and plantarflex under load. More  
36 particularly, from a point approximately 1 cm distally



1 (towards toes) from the base of the first metatarsal head,  
2 material is removed on an approximate 20 degree angle from  
3 the medial side of the orthotic. This is carried to a  
4 point approximately 1 cm from the toe end of the shell 28.  
5 A second cut with material removed is then made 20 to 25  
6 degrees to the first cut, and this terminates at the end 3  
7 of the shell 28 adjacent to the medial side of the second  
8 metatarsal of the foot 40. Shell 28 is shaped, as shown  
9 in Figure 5, such that the heel 30 of the foot 40 is  
10 carried substantially parallel or inclined slightly  
11 backward to the ground plane 57. In the particular  
12 embodiment illustrated in the instant figures, the instant  
13 orthotic device also comprises a heel post 16 that is  
14 attached to the shell 28 and also positioned beneath the  
15 heel 30 of the foot 40. The post 16 extends forwardly  
16 toward the toes 34 of the foot and terminates at 4 behind  
17 substantially immediately the heel bone 33 of the foot 40.  
18 Preferably, the post 16 is adapted to assist the shell 28  
19 in carrying the heel 30 in the substantially parallel or  
20 slightly backwardly inclined position relative the ground  
21 plan 57. Also, preferably, the heel post 16 is of a  
22 thickness to assist the shell 28 in carrying the heel 30  
23 by increasing the thickness of the post 16 from the heel  
24 30 or back part of the orthotic 6 toward the toes 34 or  
25 front part 8 of the orthotic and from an outer part 14 of  
26 the foot 40 toward the arch 38 or inner portion 12  
27 thereof. Preferably, as shown in Figures 7 and 8, post 16  
28 extends from a point under the most distal (toe side)  
29 portion of the shell 28 under the heel approximately 1-1.5  
30 cm so as to accommodate the slant of the high-heeled shoe  
31 without raising the heel of the wearer out of the back of  
32 the counter.

33 Further preferably, the shell 28 at a mid portion 20  
34 corresponding to the arch 38 of the foot 40 is curved to  
35 provide support to the arch 38. Preferably, the curvature  
36 of the shell 28 increases from the back portion 6 of the

1 orthotic to a maximum at the midpoint 20 of the shell 28  
2 and then decreases toward the termination point 3 and also  
3 increases from the outward portion 14 towards the inward  
4 portion 12. Other curvatures are also possible, so long  
5 as any such curvature is adapted to properly support the  
6 arch 38 of the foot 40 with the heel 30 of the foot 40  
7 carried substantially parallel to or inclined slightly  
8 backwardly to the ground plane, and the shell terminates  
9 slightly rearwardly of the first metatarsal head 32 of the  
10 foot 40.

11       Additionally, the orthotic device made in accordance  
12 with the present invention may comprise a cushioned,  
13 flexible extension component 10 that is attached to the  
14 shell 28 and is also positioned beneath the heel 30 and  
15 extends forwardly toward the toes 34 of the foot 40. The  
16 extension component 10 terminates at 8 behind the sulcus  
17 of the foot 40. Preferably, the extension component is  
18 made of a soft cushioning material such as PPT, or other  
19 soft cushioning materials as are well known in the art.  
20 Furthermore, although the shell 28 and heel post 16 are  
21 preferably formed of a hard rigid substance such as  
22 plastic or hard foam, other materials may also be used so  
23 long as such materials allow the heel 30 of the foot 40 to  
24 be kept substantially parallel or inclined slightly  
25 backwardly to the ground plane 57.

26       In use, the orthotic device 1 is placed within a high-  
27 heeled shoe 50 so that the back end 6 of the device 1 is  
28 flush with the back 58 of the top portion 54 of the shoe  
29 50 and the front or toe portion 8 of the device is nearby  
30 the front 56 part of the shoe 50 and point 3 terminates  
31 slightly rearwardly of the first metatarsal bend 32 of the  
32 foot. In this embodiment, the extension component 10 is  
33 within the forefoot 53 while the shell 28 is carried  
34 within the incline portion 59 and the heel post 16 is  
35 carried directly above the heel 52. When the foot 40 is  
36 inserted into the shoe 50 and placed on top of the

1 orthotic 1, preferably, the heel 30 is received into a  
2 recessed heel portion 26 that has been so adapted to  
3 receive the heel 30. The arch 38 of the foot is carried  
4 and supported by the curved portion of the rigid or semi-  
5 rigid shell 28, while the first metatarsal head 32 of the  
6 foot is left unsupported by the orthotic, and thus is free  
7 to flex. The entire foot, however, rests upon the  
8 cushioned flexible extension component 10 to provide  
9 additional wearer comfort.

10 As will be seen by those skilled in the art, the  
11 instant orthotic device provides many advantages over the  
12 prior art. Most important among these advantages is that  
13 the heel 30 of the foot 40 is carried by the orthotic 1  
14 such that it is substantially parallel to or inclined  
15 backwardly to the ground plane 57. This greatly reduces  
16 the forward inclination force of the foot 40 toward the  
17 toe part 56 of the shoe 50 and therefore prevents the toes  
18 34 of the foot 40 from becoming jammed therein, thus  
19 increasing general foot comfort and also improves posture.  
20 Thus, it would be appreciated that the instant orthotic  
21 eliminates the toe pain and general lower back pain  
22 associated with the wearing of heeled shoes and  
23 particularly the wearing of high-heel shoes. Also, since  
24 the arch 38 is supported by the curved portion of the  
25 shell 28, while the first metatarsal head is left  
26 unsupported by the orthotic, the first metatarsal is free  
27 to evert and plantarflex under load. Thus, arch pain,  
28 endemic with the use of high-heeled shoes, is virtually  
29 eliminated using the instant orthotic.

30 Also, advantageously, the instant invention permits  
31 many variations without departing from the instant  
32 invention. For example, the thickness and thickness  
33 distribution of the heel post 16 may be adapted as  
34 necessary in order to keep the heel 30 of the foot 40 in  
35 substantially parallel or slightly backwardly inclined  
36 relationship to the ground plane 57. Thus, for example,

1 in heels having 1" or less height, the thickness of the  
2 post will be slight as compared to the height of the back  
3 58 of the shoe 50, while in shoes with greater heel  
4 height, for instance, 2", the thickness of the post 16 may  
5 be made thicker toward the toes 34 or front end 8 of the  
6 orthotic so as to accommodate the increased angle of the  
7 arched portion 59 of the shoe 50 relative to the ground  
8 plane 57. Thus, it can be seen, that a great many  
9 alterations may be made to the instant orthotic to account  
10 for changes in heel heights relative to the ground plane  
11 57. Indeed, if needed, the heel post portion 16 may be  
12 eliminated entirely so that the shell 28 rests directly  
13 above the heel 52 of the shoe 50.

14 It is, therefore, evident that there is provided, in  
15 accordance with the present invention, an orthotic device  
16 that fully satisfies both the aims and objectives  
17 hereinbefore set forth. While this invention has been  
18 described in conjunction with specific embodiments  
19 thereof, it will be evident to those skilled in the art  
20 that many alternative, modifications, and variations are  
21 possible without departing from the scope of the instant  
22 invention. Accordingly, it is intended to embrace all  
23 such alternatives, modifications, and variations as fall  
24 within the spirit and broad scope of the appended claims.

-11-

## CLAIMS

1

2 What is claimed is:

3

4 1. An orthotic device for insertion into a high-  
5 heeled shoe for a human foot, said shoe having a foreshoe  
6 and a heel, each having a bottom, the intersection of  
7 which defines a ground plane, said device characterized

8

9 a. a shell 28 dimensioned to underlie the heel 30  
10 of said foot 40 and extending forwardly toward the toes 34  
11 of said foot, said shell terminating behind the five  
12 metatarsal heads 32 of said foot so as to permit the first  
13 metatarsal head freely to evert and plantarflex under  
14 load; and

15

16 b. a heel post 16 attached to said shell and  
17 dimensioned to underlie the heel of said foot and  
18 extending forwardly toward the toes of said foot, said  
19 heel post terminating adjacent the heel bone 33 of said  
20 foot, said heel post and said shell having a thickness  
21 distribution to carry said heel of said foot backwardly  
22 inclined at an angle of between about 4 degrees and about  
23 22.5 degrees relative to the ground plane.

24

25 2. An orthotic device according to claim 1, and  
26 further characterized by a cushioned, flexible extension  
27 component 10 attached to said shell and extending  
28 forwardly toward and dimensioned to at least partially  
29 underlie the toes of said foot.

30

31 3. An orthotic device according to claim 2,  
32 characterized in that said cushioned, flexible extension  
33 component 10 terminates behind the sulcus of the foot.

34

35 4. An orthotic device according to claim 1, and  
36 further characterized by a recessed heel portion 26  
37 dimensioned to underlie the heel of said foot.

38

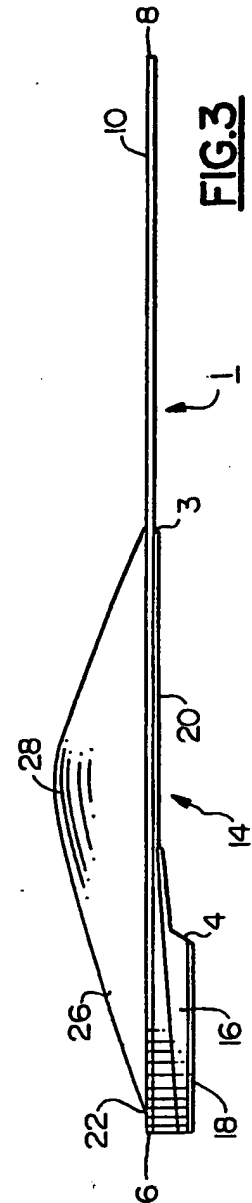
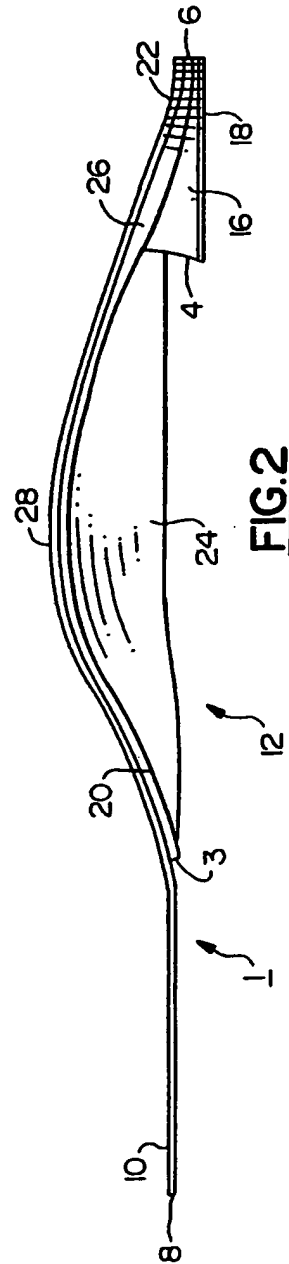
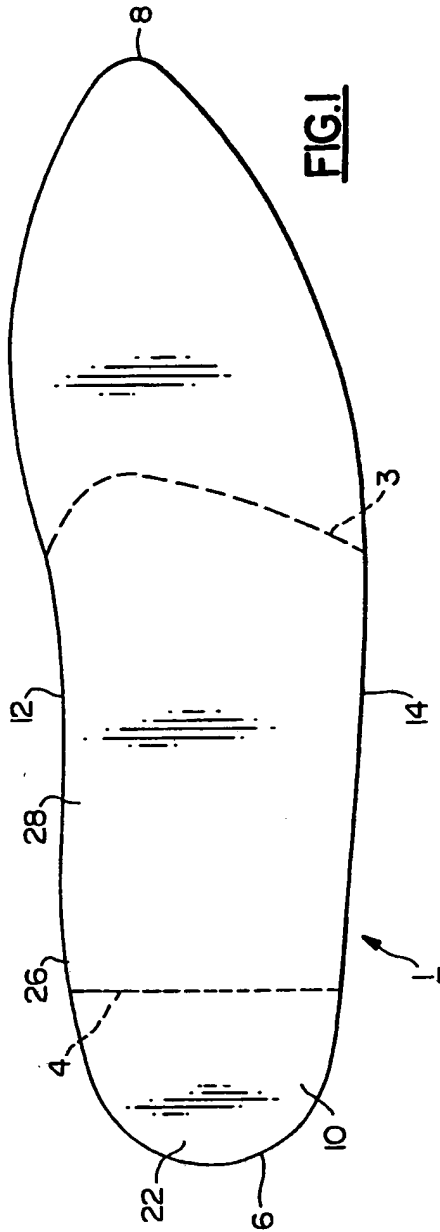
39 5. An orthotic device according to claim 1,  
40 characterized in that said shell has a curved portion 20  
41 dimensioned to underlie and support the arch 38 of said  
42 foot.

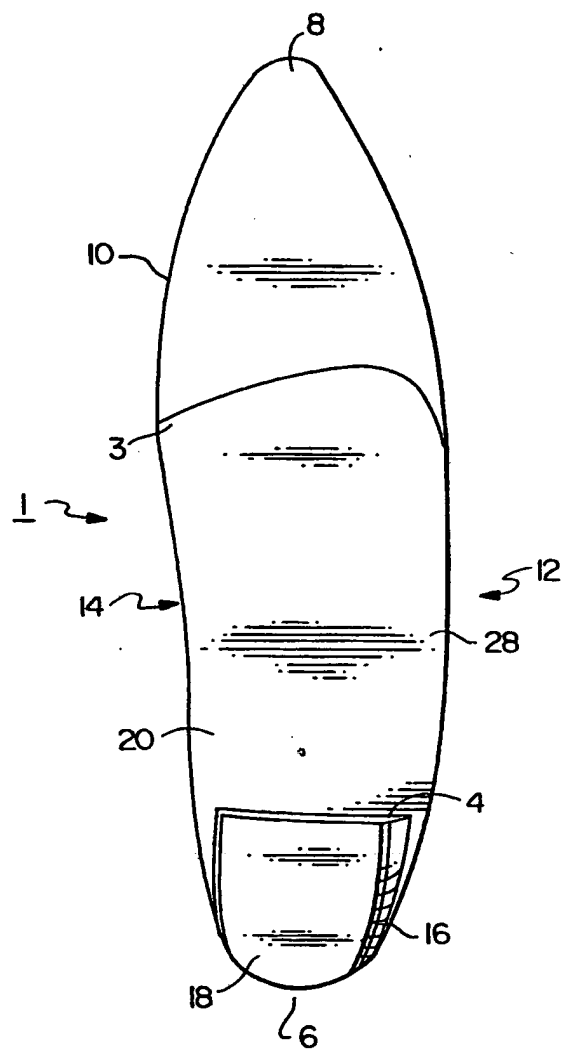
1        6. An orthotic device for insertion into a high-  
2 heeled shoe for a human foot, said shoe having a foreshoe  
3 and a heel, each having a bottom, the intersection of  
4 which defines a ground plane, said device characterized by  
5 a shell 28 dimensioned to underlie the heel 30 of said  
6 foot 40 and extending forwardly toward the toes 34 of said  
7 foot, said shell terminating adjacent the five metatarsal  
8 heads 32 of said foot so as to permit the first metatarsal  
9 head freely to evert and plantarflex under load, said  
10 shell having a thickness distribution to carry the heel of  
11 said foot backwardly inclined at an angle of between about  
12 4 degrees and about 22.5 degrees relative to the ground  
13 plane.

14       7. An orthotic device according to claim 6,  
15 characterized in that said shell 28 has a curved portion  
16 20 dimensioned to underlie and support the arch 38 of said  
17 foot and to assist in carrying said heel of said foot.

18       8. An orthotic device according to claim 7, and  
19 further characterized by a heel post 16 attached to said  
20 shell 28 and dimensioned to underlie the heel of said foot  
21 and extending forwardly toward the toes of said foot, said  
22 heel post 16 terminating adjacent the heel bone 33 of said  
23 foot, said heel post in concert with said shell carrying  
24 the heel of said foot.

25       9. An orthotic device according to claim 8,  
26 characterized in that said heel post 16 has a thickness  
27 that increases from the heel 30 of said foot toward the  
28 toes 34 thereof and from an outer part 14 of said foot  
29 toward the arch 38 thereof.



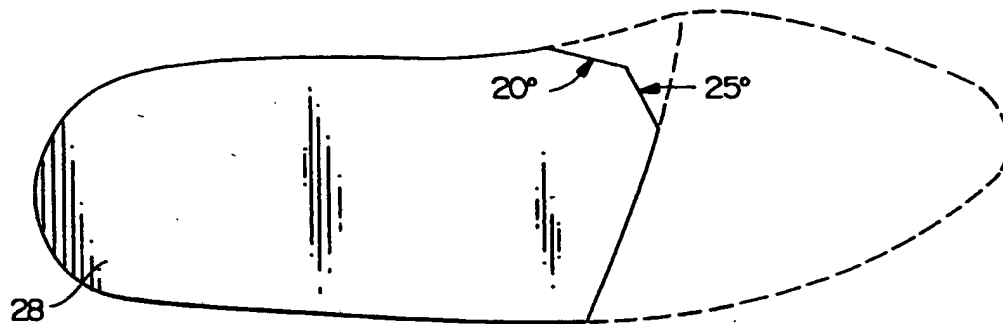


**FIG. 4**

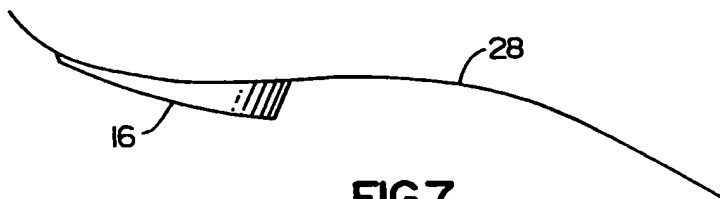




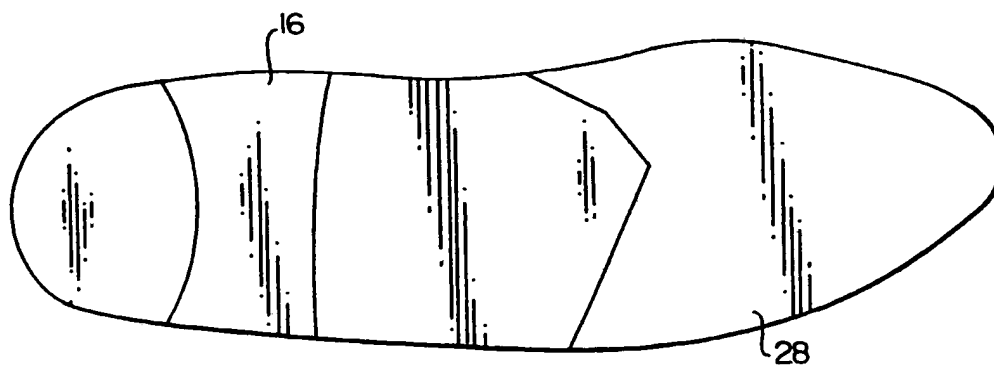
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**FIG. 6**



**FIG. 7**



**FIG. 8**

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US93/03021**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(5) : A43B 7/14, 7/16, 7/22

US CL :036/43, 140

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 36/43, 140, 44, 71, 91, 92, 166, 169, 173, 181, 172, 174, 178, 180

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
<u>X</u> Y	US, A, 2,823,469 (Eberhart) 18 February 1958, see figure 4.	<u>6</u> 1,4,5,6-9
<u>X</u> Y	US, A, 2,157,026 (Sochor) 02 May 1939, see figure 2	<u>6 and 7</u> 1 and 4-9
Y	US, A, 4,232,457 (Mosher) 11 November 1980, see whole reference	1-9
Y	US, A, 4,823,420 (Bartneck) 25 April 1989, see elements 48 and 40	2 and 3
Y	US, A 2,415,580 (Davis) 11 February 1947, see figures 3 and 4	3
A	US, A, 1,196,410 (Walker) 29 August 1916	1-9

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	* T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
* A document defining the general state of the art which is not considered to be part of particular relevance	* X	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
* E earlier document published on or after the international filing date	* Y	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
* L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	* A	document member of the same patent family
* O document referring to an oral disclosure, use, exhibition or other means		
* P document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

17 MAY 1993

Date of mailing of the international search report

19 AUG 1993

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US93/03021

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,686,993 (Grumbine) 18 August 1987	1-9
A	US, A, 2,088,263 (Grouven) 23 June 1936	1-9
A	US, A, 1,417,170 (Hosmer) 23 May 1922	1-9
A	US, A, 4,759,357 (Allart et. al.) 26 July 1988	1-9